

# FECUNDITY STUDIES ON THE CRAWFISH *PROCAMBARUS HAYI*

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## ABSTRACT

Fecundity studies were conducted on the pond crawfish *Procambarus hayi*, a species with apparent potential for commercial cultivation in northern Mississippi. Total ovarian and abdominal egg counts from adult-size females were utilized. A direct relationship existed between female size and number of eggs produced and laid. Fewer abdominal than ovarian eggs were noted in all size categories and probable reasons for this discrepancy are given. Fecundity of *P. hayi* is judged comparable to that of *P. clarkii* and *P. acutus acutus*, two commercially important species in Louisiana.

## INTRODUCTION

Quantitative studies on fecundity of crawfishes are few; most studies utilized total counts of extruded or abdominal eggs (Langlois, 1935; van Deventer, 1937; Tack, 1941). Eggs of crawfishes may become detached from the female pleopods and total abdominal egg counts would not represent the potential fecundity of a species. Ovarian egg counts estimate the gross fecundity and, when used in conjunction with total abdominal egg counts, provide a better estimate of the potential fecundity of a species. Penn (1943), Smith (1953) and Smart (1962) utilized total ovarian egg counts to express reproductive potential in *Procambarus clarkii*, *Faxonella clypeatus*, and *Cambarus longulus longulus* respectively; Prins (1968) combined both types of egg counts in describing the fecundity of *Orconectes rusticus rusticus*.

Fecundity studies were conducted on the crawfish *Procambarus hayi* (Faxon) from two ponds in the vicinity of State College, Mississippi. This species, which reaches

large population sizes in shallow farm ponds in the northern portion of Mississippi, has apparent potential for commercial cultivation. *P. hayi* compares favorably in size with *P. clarkii* and *P. acutus acutus* (= *P. blandingii acutus*), the two principal species of commercial importance in Louisiana. Various aspects of crawfish cultivation in Louisiana are noted by Viosca (1961), LaCaze (1966), Avault et al. (1970) and Ham (1971). Cultivation of *P. hayi* would provide crawfish specimens for human consumption, for bait and for use in biological investigations. The reproductive capacity of this species, herein reported, would be important in determining what quantity could be removed prudently from a given locality.

## THE REPRODUCTIVE CYCLE

During September and October females of *P. hayi* oviposited within burrows near pond margins; after hatching, juveniles of 4.3 to 4.7 mm carapace length left the burrows and appeared in the open water from September through mid-December. These juveniles reached adult size (28.0 to 32.0 mm carapace length) by July or August of the following year. Penn (1943) reported edible size for *P. clarkii* at 30.0 mm carapace length; similar sized individuals of *P. hayi* were most abundant in open water during spring and early summer.

## METHODS OF STUDY

In July and August of 1967, the peak of ovarian egg development, adult females were removed from the study ponds, their ovaries removed and placed in 70% ethyl alcohol solution, and counts of ovarian eggs made by removing eggs singly with forceps and probe. Total counts were made for 76 adult females varying in carapace length from 35 to 47 mm.

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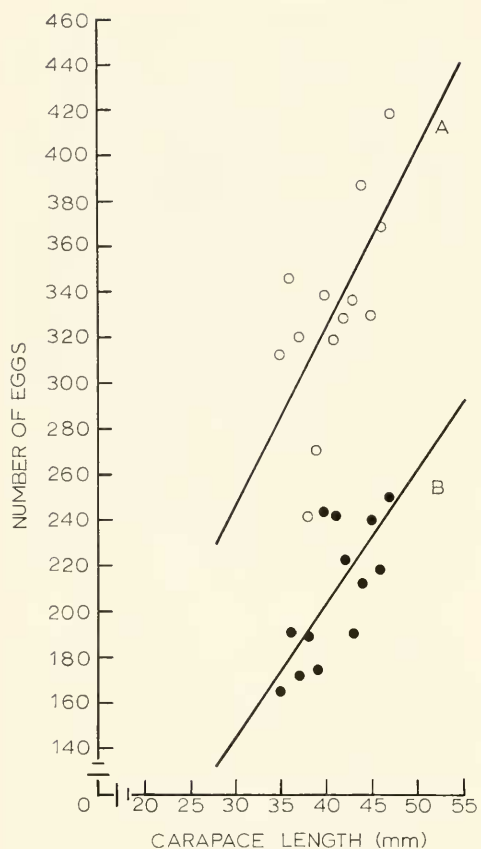


Figure 1. Regression of number of eggs on carapace length of *Procamburus hayi*. Line A represents ovarian eggs (regression equation:  $8.33 + 7.87X$ ); line B represents abdominal eggs (regression equation:  $-34.31 + 5.91X$ ). In the scatter diagram, open circles are means of ovarian egg counts; dark circles are means of abdominal egg counts.

Counts of abdominal, or extruded eggs were made on individuals confined in laboratory aquaria. Following oviposition females were removed from the aquaria, their carapace length measured, and the abdominal eggs counted. It is believed that more accurate counts of extruded eggs were obtained on these females than on those collected in the field, for securing ovigerous females in their native habitat required complete excavation of their burrows. Such disturbances and handling resulted in the loss of many eggs; consequently, data from these excavated females were not included in the regression analysis presented below. From June, 1966, through March, 1968, 64 females became ovigerous in the laboratory aquaria.

#### RESULTS AND DISCUSSION

Maximum and minimum egg counts for each mm size class are given in Table 1. Ovarian egg counts ranged from 221 to 463; abdominal egg counts ranged from 60 to 340. The number of eggs varied considerably in different specimens, however, a positive correlation existed between carapace length and number of eggs produced and laid (Fig. 1). The correlation coefficient for ovarian eggs was 0.630 and that for abdominal eggs was 0.663. Regression analysis revealed that for each 1 mm increase in carapace length there was a corresponding 7.87 increase in ovarian eggs and a 5.91 increase in abdominal eggs. A direct relationship between length and total number of abdominal eggs was first noted by van Deventer (1937) in studies of *O. propinquus*; other investigators reported similar findings for ovarian or abdominal

TABLE 1. Ovarian and abdominal egg counts for various size categories of *Procamburus hayi*.

Carapace Length (mm)	Sample Range Ovarian Eggs	Integral Mean Ovarian Eggs	Sample Range Abdominal Eggs	Integral Mean Abdominal Eggs
35	275-340	312	110-211	165
36	311-375	346	148-230	191
37	234-381	320	160-180	171
38	221-295	241	128-260	190
39	236-325	270	82-225	174
40	258-417	339	85-300	244
41	220-421	318	180-288	242
42	279-311	328	122-286	222
43	268-387	336	128-280	190
44	350-426	386	135-340	212
45	222-417	329	200-273	240
46	315-427	368	60-218	218
47	382-463	418	241-259	250

eggs in various species (Tack, 1941; Penn, 1943; Smart, 1962 and Prins, 1968).

Consistently fewer abdominal eggs were noted when compared with ovarian egg counts from the same female size category; the margin of difference between the two measurements increased with carapace length (Fig. 1). Prins (1968) reported a similar condition in *O. v. rusticus* and attributed differences in part to the rigors of the lotic environment of this species. In *P. hayi* smaller numbers of extruded eggs apparently resulted from several causes: failure of certain eggs to be fertilized and/or attached; loss of some eggs to predation by the brooding female; and incomplete extrusion of eggs. Penn (1943) and Smith (1953) reported that other species failed to extrude completely all of the ovarian eggs; a resorption of remaining eggs followed.

For specimens with carapace length of 35.0 to 43.0 mm, the figures reported here compare favorably with those noted for *P. clarkii* by Penn (1943). Samples from larger specimens indicated that *P. clarkii* had a greater reproductive potential. Larger specimens of *P. hayi* probably compare more closely with *P. a. acutus*, although no data on fecundity for this species are available. LaCaze (1966) indicated *P. a. acutus* was less productive than *P. clarkii* but still capable of producing excellent crops when properly stocked.

#### SUMMARY AND CONCLUSIONS

1. Fecundity studies of the pond crawfish, *Procambarus hayi*, were conducted utilizing total ovarian and abdominal egg counts from females ranging from 35.0 to 47.0 mm carapace length.

2. Ovarian egg counts were made on specimens collected from two ponds in the vicinity of State College, Mississippi; abdominal egg counts were taken from speci-

mens confined in laboratory aquaria since females in the habitat retreat to burrows for oviposition.

3. A positive correlation existed between carapace length and total number of ovarian and abdominal eggs produced. In each category females consistently produced more ovarian than abdominal eggs. Females ranging in carapace length from 35.0 to 43.0 mm exhibited potential fecundity equivalent to that of *P. clarkii*, a commercially important species in Louisiana. Fecundity and relative abundance in shallow farm ponds in northern Mississippi indicate that *P. hayi* has commercial harvest potential.

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